

WEBVTT

1

00:00:10.290 --> 00:00:15.179

Ana Bonaca: You're recording. And just as a gentle reminder if I run like that.

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00:00:15.780 --> 00:00:33.660

Ana Bonaca: August 20 minutes I'll give you a five minute warning with a bell sound and then we have a time for 10 minutes of questions, so please don't be shy with all of your questions and either the on Slack or here on the zoom chat and Morgan will be handling the Q AMP. A. So take it away.

3

00:00:35.850 --> 00:00:37.110

Leonardo Dos Santos: Thank you. Let me

4

00:00:37.140 --> 00:00:38.940

Ana Bonaca: start sharing my screen.

5

00:00:41.430 --> 00:00:42.210

Okay.

6

00:00:45.420 --> 00:00:52.950

Leonardo Dos Santos: All right, are you, are you seeing like a little zoom thing here because it is on my screen.

7

00:00:55.020 --> 00:00:55.590

Ana Bonaca: No.

8

00:00:56.160 --> 00:00:57.240

Leonardo Dos Santos: No. All right, time then

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00:00:57.960 --> 00:00:59.730

Morgan Elowe MacLeod: We see your cursor, though. Yeah.

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00:01:00.300 --> 00:01:02.430

Leonardo Dos Santos: Oh yeah, the cursor is fine. Alright, cool.

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00:01:03.900 --> 00:01:09.120

Leonardo Dos Santos: Well, thank you all for for coming to to the seminar, I really appreciate it.

12

00:01:10.170 --> 00:01:10.530  
Leonardo Dos Santos: And

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00:01:11.640 --> 00:01:18.300  
Leonardo Dos Santos: So my research I considered that planets, they are in many ways very similar to stars, even though it's more planets.

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00:01:19.050 --> 00:01:31.920  
Leonardo Dos Santos: And I think, I think part of that is because of my sort of my scientific upbringing and astronomy. I started doing research with stars, and then it transitions to exoplanet so I when I started out like to see them all together as a system.

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00:01:32.970 --> 00:01:33.420  
Leonardo Dos Santos: And

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00:01:34.860 --> 00:01:42.000  
Leonardo Dos Santos: Planets. They also evolve and the change in the same time scales as their whole stars, particularly when it comes to the atmospheres.

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00:01:42.690 --> 00:01:55.020  
Leonardo Dos Santos: And one of my favorite examples is actually in the solar system. And if I can pass this line. There you go. It's Mars. We think that its atmosphere and surface changed a lot through time.

18

00:01:55.950 --> 00:02:08.610  
Leonardo Dos Santos: And in my research, I studied the upper parts of the atmosphere in the exosphere use of exoplanets. And these parts are very exposed to hype to the high energy, environment, provided by the whole star.

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00:02:09.540 --> 00:02:17.310  
Leonardo Dos Santos: And we know that evolved significantly, particularly in the early ages of the other side of the planetary system.

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00:02:18.150 --> 00:02:34.770  
Leonardo Dos Santos: Now the atmosphere, it's structured I refer to something like this. So you have your planet in red and orange and yellow. We have the lower and upper atmosphere which are which contain gas in a collision regime and when you go to the, what we call the exosphere That's by definition.

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00:02:35.790 --> 00:02:41.250

Leonardo Dos Santos: The collision collision with this regime for for its gas.

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00:02:42.630 --> 00:02:54.900

Leonardo Dos Santos: every planet has an exosphere even the earth. This how the Earth's axis free looks like. This is one of my favorite observations ever because it was a small satellite launched by a team in Japan.

23

00:02:55.470 --> 00:03:11.130

Leonardo Dos Santos: And I think this observation was the can. I think 1.5 a year. This and from the earth and the earth is this is the central pixel right here is this tiny little thing. And there's giant blob that you see is our on exosphere made of mostly hydrogen

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00:03:13.020 --> 00:03:29.820

Leonardo Dos Santos: And as I said, the these layers. They are very explosive high energy, environment around the planet and the react to it. And one of their main reactions is what we call atmospheric escape when the gas particles are not gravitationally bound to the planet anymore.

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00:03:31.020 --> 00:03:31.350

And

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00:03:32.700 --> 00:03:40.980

Leonardo Dos Santos: I guess a quick nutshell explanation of this process is wanted. So when you have your planet right here.

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00:03:41.430 --> 00:03:49.890

Leonardo Dos Santos: And it receives a lot of high energy radiation, usually, usually in the form of X rays and extreme ultraviolet. This will cause eating an

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00:03:50.790 --> 00:04:09.720

Leonardo Dos Santos: Animal spirit expansion and when the collision all layers which yearning RA orange and yellow when they overflow the rush radius which he is and whites, the circle. The white circle when they overflowed that limit we have we have hydrodynamic escape.

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00:04:10.920 --> 00:04:19.080

Leonardo Dos Santos: Now, this process is very vigorous and it can potentially your road, a significant part of the atmosphere of small planets.

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00:04:19.950 --> 00:04:30.780

Leonardo Dos Santos: And this is especially important for young planets, because when the system is young, the star emits a lot more high energy radiation. So that's when we think that the

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00:04:31.290 --> 00:04:39.870

Leonardo Dos Santos: Planets, or at least short period planets was the bulk of their atmosphere. Sometimes the primordial Masri can be completely eroded.

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00:04:41.100 --> 00:04:43.590

Leonardo Dos Santos: Especially for rocky planets.

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00:04:45.480 --> 00:05:04.350

Leonardo Dos Santos: Harder than we think. Hydrodynamic escape is so pervasive and short period planets exoplanets, because a it imprints features in the population of exoplanets. So here on the left, you have the fame now famous radius gap.

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00:05:05.580 --> 00:05:12.300

Leonardo Dos Santos: In which planets with radius around 1.8 or 3D I are

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00:05:12.390 --> 00:05:13.080

Ana Maria Delgado: Rare

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00:05:13.380 --> 00:05:14.520

Leonardo Dos Santos: Or we have this gap.

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00:05:14.610 --> 00:05:15.990

Leonardo Dos Santos: In their population right here.

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00:05:17.130 --> 00:05:30.660

Leonardo Dos Santos: Another interesting feature is called the hot Neptune desert which which is here under rights, we see a lack of Neptune sized planets that are very radiated and in this triangle right here.

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00:05:31.980 --> 00:05:39.210

Leonardo Dos Santos: We think that these two features they are more mainly carve cards by atmosphere escape.

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00:05:42.660 --> 00:05:52.470

Leonardo Dos Santos: Having that in mind. One of the ways that you can infer study atmosphere to escape and exoplanets is by observing it directly or semi directly

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00:05:53.340 --> 00:06:02.910

Leonardo Dos Santos: And you can one of my colleagues assemble here. What he does is to make simulations based on observations. He makes simulations of the escape.

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00:06:03.870 --> 00:06:13.950

Leonardo Dos Santos: Dynamical simulations of the escaping exosphere of exoplanets. So here on the left we have an example GG four to six be which I'll briefly explain soon.

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00:06:14.670 --> 00:06:31.380

Leonardo Dos Santos: And the rights, we have an audit simulation. This time for the helium reach thermosphere and also a little bit of exosphere helium here and blue for the warm natural happy 11 be which was recently discovered to have this medium rich

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00:06:33.030 --> 00:06:34.680

Leonardo Dos Santos: Atmosphere very recently.

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00:06:37.140 --> 00:06:46.710

Leonardo Dos Santos: And by the way, these two simulations. They were base with with transmission spectroscopy, both in Lima off, which is an ultraviolet and helium in the infrared.

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00:06:48.180 --> 00:06:58.740

Leonardo Dos Santos: But let's quickly do a little bit of history lesson. Because back in 2003 the first section of an access here on an exoplanet was published.

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00:06:59.220 --> 00:07:04.830

Leonardo Dos Santos: And it's, it was around the world now well known how Jupiter eight or 9458 be

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00:07:05.610 --> 00:07:14.130

Leonardo Dos Santos: Using lemon off the transmission spectroscopy. So here on the left. So you have the lemon off emission of the whole star and you observe it before and during the transit.

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00:07:14.730 --> 00:07:26.550

Leonardo Dos Santos: Usually nowadays we also observe after the transit as well. But for this particular case the had only before and during and we look for changes in the seller spectrum. The lemon office spectrum.

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00:07:28.110 --> 00:07:39.960

Leonardo Dos Santos: When the planet best in front of the whole star. Now the second variable is different. It's a little bit different from transmission spectroscopy longer wavelength, because usually we don't have a lot of continuum flux

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00:07:40.440 --> 00:07:46.920

Leonardo Dos Santos: And ultraviolet, particularly for small stars. So usually work with the Lima with the emission lines.

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00:07:48.510 --> 00:08:05.190

Leonardo Dos Santos: Anyway, here in the rights, we have the light curve or the Lyman offer then pass in. We see that. And by the way, the transit is the limited by the vertical lines and we see that during the transit the flux, flux decreases by 15% now we know from

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00:08:06.300 --> 00:08:21.030

Leonardo Dos Santos: Otter measurements that your bait disk of this Hot Jupiter blocks, approximately, I think 1% of the study. Right. So this additional 50% here is caused by a hydrogen cloud that surrounds this hard Jupiter.

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00:08:24.270 --> 00:08:27.750

Leonardo Dos Santos: But I would say that the most spectacular case it's a tactic.

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00:08:29.040 --> 00:08:35.880

Leonardo Dos Santos: To this day is the warm Neptune two different to six be just published back in 2015

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00:08:36.990 --> 00:08:48.720

Leonardo Dos Santos: And we, if you look at the cell. I'm often mission during the transit, you see that it increases by 50% which is to this date, I think, is the strongest atmospheric signal ever detective for an exoplanet

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00:08:49.950 --> 00:08:54.030

Leonardo Dos Santos: And you're on the right to have a simulation of the exosphere did you four to six.

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00:08:55.440 --> 00:09:09.870

Leonardo Dos Santos: We think that this large, very large. Oh, by the way, this cloud is larger than the whole star. And we think that one of the ways that you can feed this this large cloud is by hydrodynamic escape.

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00:09:11.520 --> 00:09:25.740

Leonardo Dos Santos: So one of my one of the projects that my PhD, we were trying to find medals in the accessories you for 260 which would be a smoking gun evidence for how to dynamic escape. So we're looking for things like civic on carbon and oxygen.

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00:09:26.490 --> 00:09:34.500

Leonardo Dos Santos: And this time, instead of this this paragraph on Hubble use the cost of spectrograph and now you see why that was important in a few minutes.

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00:09:35.400 --> 00:09:52.830

Leonardo Dos Santos: We did not find evidence for metals. We found a lot of stellar activity, which is kind of a trend in Knoxville, Tennessee. Think you found something that was probably so the activity. So here you have like curves of Judea for just six phase for the to the rotation of period of the star.

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00:09:53.880 --> 00:10:03.570

Leonardo Dos Santos: And we see a very clear sign of soil modulation, which we attribute to a long lived active region in the surface of G four to six.

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00:10:04.890 --> 00:10:11.970

Leonardo Dos Santos: Even having a manager for just six is considered a quiet and forth, but when you go to filter by late wavelength, things got

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00:10:13.980 --> 00:10:15.810

Leonardo Dos Santos: More active as it seems.

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00:10:17.370 --> 00:10:31.080

Leonardo Dos Santos: And this activity region was stable for a few years, which is kind of impressive if you think about solar type stars, they are at their active regions usually last few days before Mr. Second to last a few years up to 60 rotations.

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00:10:31.680 --> 00:10:40.590

Leonardo Dos Santos: Now this is not unheard of. We know that Proxima Centauri, for instance, has an active had an active region there was stable for nine years, or were approximately nine years.

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00:10:42.360 --> 00:10:49.470

Leonardo Dos Santos: Okay, but we didn't detect metals into different your six people. We did manage to reproduce the lemon offered transit of the planet.

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00:10:50.100 --> 00:10:59.280

Leonardo Dos Santos: And this is significant because we usually don't use cause for alarm on alpha spectroscopy because cost is a circle average respect. So there's a lot of geographic contamination in it.

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00:11:00.150 --> 00:11:12.810

Leonardo Dos Santos: But we came up with this technique to get rid or to remove efficiently. Remove the contamination from costs spectrum even four stars or it's obvious that is faint as you do four through six.

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00:11:14.040 --> 00:11:31.110

Leonardo Dos Santos: And we managed to reproduce the the signal and other interesting conclusion from this result here is that the atmospheric escape internet four to six stable defer to six be the planet is stable because there's observations rate then many years after this, this detection.

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00:11:32.580 --> 00:11:39.390

Leonardo Dos Santos: So hot tip from me, if you want to do Lima and offer transit spectroscopy for, for, for instance, a bright tests target.

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00:11:40.290 --> 00:11:47.250

Leonardo Dos Santos: Just go for it costs because it has better sensitivity. He has better wavelength coverage better resolution in nominal mode.

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00:11:47.700 --> 00:12:05.280

Leonardo Dos Santos: And Leto to know systematics at all when compared to this now you only have to deal with the draconian contamination, but there are public resources to do with that they're probably journal templates that you can use and the code that I use to make this move is also publicly available.

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00:12:06.930 --> 00:12:14.820

Leonardo Dos Santos: Alright, so this is all say not only use atmospheric information. They also use information about the high energy, environment around the planet.

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00:12:15.480 --> 00:12:24.360

Leonardo Dos Santos: So for instance, there is this very recent study and I found a really cool published by Kevin France and collaborators in which the observed

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00:12:24.810 --> 00:12:33.090

Leonardo Dos Santos: Barnard star, which was recently discovered to have a rocky planets orbiting it and during the Hubble observation was five orbits, they

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00:12:33.870 --> 00:12:42.060

Leonardo Dos Santos: Measure to flares. So they are able to infer about the UV spectrum of the side, both at quiescence state flare state.

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00:12:42.960 --> 00:13:01.350

Leonardo Dos Santos: And even cooler, I think, is the simulated atmospheric escape in the rocky planet at both quiet state and flare state and I want to leave the conclusions they they arrived to is that even at the activity level that we observe today a barn starts as a 10 billion year old store.

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00:13:02.670 --> 00:13:08.760

Leonardo Dos Santos: The planet would still be able to retain a secondary atmosphere which is a very cool result.

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00:13:10.950 --> 00:13:21.690

Leonardo Dos Santos: Okay, just switching gears a little bit from ultra violent and Space. Space spectroscopy. Let's move on to infrared because very recently, people have been using the helium triplet in

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00:13:21.750 --> 00:13:27.570

Leonardo Dos Santos: One micron to also in for a biosphere escape and input in exoplanets.

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00:13:28.290 --> 00:13:39.720

Leonardo Dos Santos: There is this paper here, published in 2018 production of helium was one or seven the and the helium channel is this blue line right here.

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00:13:40.170 --> 00:13:50.160

Leonardo Dos Santos: By the way, this is a low resolution transit spectroscopy and there are other features here like water, for instance, but one of the main features in the speaker was the helium detection.

84

00:13:51.450 --> 00:13:56.460

Leonardo Dos Santos: But because it's the infrared. You can also do this from the ground in high resolution, this time.

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00:13:57.090 --> 00:14:11.010

Leonardo Dos Santos: He says he can use Carmen, this and this is what one of my colleagues hormonal I did and they detected a helium rich

thermosphere and a little bit of exosphere helium unhappy 11 be which is another warm Neptune.

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00:14:12.180 --> 00:14:15.990

Leonardo Dos Santos: Somewhat similar to three or four to six not very similar but somewhat similar.

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00:14:17.040 --> 00:14:20.880

Leonardo Dos Santos: And when you have a rival high resolution, the advantages, you can start doing

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00:14:22.050 --> 00:14:27.750

Leonardo Dos Santos: Some simulation some dynamical simulations for the atmospheric escape like my other colleague does

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00:14:28.980 --> 00:14:35.400

Leonardo Dos Santos: Anyway, there are many instruments from the ground that you can use to do helium three blood transmission spectroscopy.

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00:14:35.940 --> 00:14:47.370

Leonardo Dos Santos: But as far as I know, there's only one in the southern hemisphere. If somebody knows and I want to sell me. But as far as I know, there is only Phoenix. The Phoenix particular graph in Gemini self.

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00:14:48.390 --> 00:15:01.020

Leonardo Dos Santos: And which is a visiting instruments on Gemini. And last year we obtain a DDT program to do transmission spectroscopy for was 120 17 with, not to be confused with one or 70 this one.

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00:15:01.770 --> 00:15:16.380

Leonardo Dos Santos: I wanted to do was one also imbued with it wouldn't be wouldn't be available in the timeframe that we had. So we went for a walk 127, he said, and the results. These are the results here on the left you have time series of the transit spectra and

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00:15:17.730 --> 00:15:19.560

Leonardo Dos Santos: Unfortunately, it's a non detection, if

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00:15:19.830 --> 00:15:30.360

Leonardo Dos Santos: If we had a signal would be some something like yellow blob following these red lines, but unfortunately don't see it. And here on the right, you have the combined transmission spectrum.

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00:15:32.010 --> 00:15:37.950

Leonardo Dos Santos: And we think that the reason this plan doesn't exhibit a helium future is because it's a very old system.

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00:15:39.780 --> 00:15:41.850

Leonardo Dos Santos: There's an emerging trend among

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00:15:45.120 --> 00:16:00.930

Leonardo Dos Santos: gas giants that were observed for him transit spectroscopy. It seems that those that are that we see that a lot of high energy radiation which here in this block are on the right. So these ones they exhibit a strong helium future while those that are not

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00:16:02.340 --> 00:16:10.380

Leonardo Dos Santos: As much radiator. The high energy like was 179 be easier for six, be they don't exhibit that future

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00:16:10.920 --> 00:16:25.080

Leonardo Dos Santos: Things start to get a little bit more complicated for subscriptions. It's super urs which here in red because we had not obtained any or any detection. So far so we cannot see the same, we cannot say that they also have the same trend.

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00:16:26.100 --> 00:16:29.340

Leonardo Dos Santos: We need to increase the sample for some Neptune's

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00:16:33.570 --> 00:16:34.860

Leonardo Dos Santos: There too.

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00:16:36.330 --> 00:16:40.320

Leonardo Dos Santos: So just coming back to those features that I mentioned the desert in the valley there to

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00:16:40.620 --> 00:16:51.390

Leonardo Dos Santos: Not competing, but there are two hypotheses to explain it. And one of them is 40 evaporation, which is when you haven't the external your radiation from the whole star that sweeps away the planets atmosphere.

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00:16:52.020 --> 00:16:59.940

Leonardo Dos Santos: As an order Hepworth is called corporate mass loss which is based on the internal energy of the planet that causes the atmospheric escape.

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00:17:00.960 --> 00:17:03.240

Leonardo Dos Santos: But we don't know if we don't understand

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00:17:04.560 --> 00:17:16.320

Leonardo Dos Santos: That, well, what's the respective role of each of these processes in shaping these features. So one way to test this hypothesis to observe young planets and escape young planets.

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00:17:17.010 --> 00:17:27.450

Leonardo Dos Santos: Having that in mind I lead a hobo observing program last year to try to detect the hydrogen rich exosphere of the S to the

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00:17:28.410 --> 00:17:39.690

Leonardo Dos Santos: Young transiting planet recently discovered by tests and I will show you a sneak peek preview of one of the results that we got. But keep in mind that these are putting them in the area results.

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00:17:40.380 --> 00:17:58.770

Leonardo Dos Santos: In I show you the liker one of the light curves of the SU AB and we see a decreasing flux of approximately 40% a little bit before the transit and during the transit as well. And we think that this suggests the presence of an exosphere in this planet to

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00:18:00.120 --> 00:18:08.280

Leonardo Dos Santos: The data analysis currently underway and we plan on publishing and very soon. Hopefully still this year, so keep an eye out for that.

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00:18:09.330 --> 00:18:18.060

Leonardo Dos Santos: Also, keep an eye out for more young planets, because I know that are I know at least a few groups out there, not only

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00:18:18.690 --> 00:18:30.960

Leonardo Dos Santos: My collaborations. But we're also going to do something, they're also doing he didn't or lemon offer transit spectroscopy for a young planners and everyone wants to detect those access for us.

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00:18:31.920 --> 00:18:40.530

Leonardo Dos Santos: Also, I think collaborating with a team sci fi composed by NASA alum and James career can reset. As long as more dollars.

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00:18:41.100 --> 00:18:53.130

Leonardo Dos Santos: And we have a program with calculus back to detect helium in young planets in three young planets, your observations will be carried out by the end of the year, and hopefully we'll have results by next year.

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00:18:54.600 --> 00:19:07.920

Leonardo Dos Santos: And okay, I'm almost finished with my talk, and they and I want to leave you with a something that I think will have reserved for us when it comes to ultraviolet transit spectroscopy.

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00:19:08.760 --> 00:19:20.430

Leonardo Dos Santos: So you remember this, the Earth's axis three that I shown in the beginning, actually one of my first projects during my my PhD was to take this observation and the model.

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00:19:20.970 --> 00:19:34.290

Leonardo Dos Santos: That one of my collaborators created based on this observation and we wanted to simulate how this would look like if we had an earth like exosphere transiting in nearby and dwarf and

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00:19:35.880 --> 00:19:43.500

Leonardo Dos Santos: So we made those simulations that unfortunately the signal would be too shallow for Hubble not be detectable right now.

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00:19:44.400 --> 00:19:56.130

Leonardo Dos Santos: But it is that it would be detectable we live wire in the loo most spectrograph in 10 transits if if if we're using the largest design for the wire.

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00:19:56.730 --> 00:20:12.450

Leonardo Dos Santos: With what we're currently has two designs, one for 12 meters, one for nine meters, as far as I remember, and the case for the smaller design, it would take something like 15 to 20 transits to detect in North like exosphere around the rocky planets orbiting and worse.

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00:20:13.740 --> 00:20:19.320

Leonardo Dos Santos: And this is cool because it provides another pathway to detect earth like conditions in rocky planets.

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00:20:21.240 --> 00:20:33.150

Leonardo Dos Santos: Okay, so we'll finish my talk normally I leave a few take home messages for the senses short format. I guess I will leave you with one hot tip.

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00:20:33.720 --> 00:20:51.090

Leonardo Dos Santos: If you want to you if you want to do. Helium transmission spectroscopy for Southern Hemisphere targets definitely apply for time on Gemini south in the Phoenix spectrograph it's currently the only one available to do that, as far as I know, and that there are some caveats, and

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00:20:52.440 --> 00:21:00.930

Leonardo Dos Santos: If you have any questions that I can, I can answer. So thank you for for your attention and I'm open to any questions you may have.

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00:21:06.210 --> 00:21:06.510

Ana Bonaca: Thank you.

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00:21:08.760 --> 00:21:09.480

Morgan Elowe MacLeod: Thank you, Linda.

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00:21:10.590 --> 00:21:26.880

Morgan Elowe MacLeod: Well, this is really wonderful and and also I mean I should say that we're delighted that you're taking all these beautiful spectra and and analyzing this work and like that. Is that sort of personal gratitude extends through the fact that I don't have to

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00:21:27.810 --> 00:21:29.760

Morgan Elowe MacLeod: Buy someone to come back to

129

00:21:32.220 --> 00:21:33.630

Morgan Elowe MacLeod: Ds talk

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00:21:34.830 --> 00:21:39.240

Morgan Elowe MacLeod: And your observations there. And I wondered if we could look at that, like curve together.

131

00:21:39.870 --> 00:21:40.290

Yeah.

132

00:21:41.760 --> 00:21:42.240

Morgan Elowe MacLeod: So,

133

00:21:43.440 --> 00:21:45.600

Morgan Elowe MacLeod: This is Lyman alpha is that correct

134

00:21:46.200 --> 00:22:00.420

Morgan Elowe MacLeod: Yeah, okay. And something I was wondering if I'm correct in seeing is that the deepest parts of the transit are at times of minus three or minus two, something like that ours.

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00:22:01.290 --> 00:22:01.560

Leonardo Dos Santos: Yeah.

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00:22:01.710 --> 00:22:12.150

Morgan Elowe MacLeod: Can you talk about the geometry relative to the orbit. And what that might mean for the shape of this exosphere sort of size relative to the orbit what

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00:22:12.150 --> 00:22:14.850

Morgan Elowe MacLeod: Or how can we sort of reconstruct that

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00:22:15.540 --> 00:22:23.850

Leonardo Dos Santos: Yeah, with think it's similar to DJ for six. If I go back a few slides, we think it's something similar to this, except that I

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00:22:25.080 --> 00:22:34.530

Leonardo Dos Santos: Saw the transit happens a few hours before. So we're actually doing like some kind of like backhoe back of the envelope calculation this morning and we

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00:22:34.530 --> 00:22:39.540

Leonardo Dos Santos: Think that the exosphere would extend to something like to Planet radio beyond

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00:22:39.570 --> 00:22:40.740

Leonardo Dos Santos: The planet itself.

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00:22:41.340 --> 00:22:43.500

Leonardo Dos Santos: But that's only considering if it was a

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00:22:44.040 --> 00:22:47.010

Leonardo Dos Santos: No peak, this kind of thing. Sure.

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00:22:47.070 --> 00:22:50.250

Leonardo Dos Santos: Because it's diffuse, it's probably extends to a lot more than

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00:22:50.250 --> 00:22:59.250

Leonardo Dos Santos: That. So we think it probably has a similar to like a commentary shape like four to six be as well. Interesting, interesting.

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00:22:59.700 --> 00:23:03.720

Leonardo Dos Santos: And but in order to have any constraints on geometry we need to run simulations and

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00:23:03.720 --> 00:23:07.830

Leonardo Dos Santos: We we plan on doing the simulations. As soon as soon as we finished.

148

00:23:07.860 --> 00:23:09.840

Morgan Elowe MacLeod: Doing the data analysis itself.

149

00:23:11.280 --> 00:23:19.740

Morgan Elowe MacLeod: Awesome. And if we keep thinking about this exosphere or or similar ones. Avi lobe is asking

150

00:23:22.200 --> 00:23:23.820

Morgan Elowe MacLeod: If we if we

151

00:23:24.990 --> 00:23:29.370

Morgan Elowe MacLeod: Like dig to the earth centered observations like

152

00:23:29.430 --> 00:23:33.060

Morgan Elowe MacLeod: Looking back at Earth that beautiful, you mentioned that you started with, and

153

00:23:34.290 --> 00:23:40.980

Morgan Elowe MacLeod: You're thinking about Lou voir and and sort of the future detection of this sort of thing. Can we talk about

154

00:23:42.060 --> 00:23:49.380

Morgan Elowe MacLeod: You know, this week's observations of Venus and what would it take to detect bio signatures and those sorts of spectra.

155

00:23:52.230 --> 00:24:00.060

Morgan Elowe MacLeod: Like, would your earth observation, what would it take to show bio signatures in that in your observations of her

156

00:24:01.050 --> 00:24:16.470

Leonardo Dos Santos: Oh this uh the the hydrogen observation. It's basically if we observe these, this thing is hydrogen. So if you observed

something like this, we could only for we can only say on this planet has a an accessory similar to the earth.

157

00:24:16.860 --> 00:24:18.240

Leonardo Dos Santos: Now in the case of the earth.

158

00:24:18.720 --> 00:24:33.360

Leonardo Dos Santos: We think that the sexes three is mostly fed by footed the association of water. So we have water molecules that go to the upper atmosphere of the earth, and they photo they associated because of the radiation from the whole star.

159

00:24:33.720 --> 00:24:35.370

Leonardo Dos Santos: So hydrogens very lights.

160

00:24:35.460 --> 00:24:39.540

Leonardo Dos Santos: It will escape the our atmosphere and will populate our exosphere

161

00:24:40.770 --> 00:24:50.370

Leonardo Dos Santos: We think we could say if we detect something like this around a rocky planet we could say are the spring. It has water in the lower parts of the atmosphere.

162

00:24:51.300 --> 00:24:58.710

Leonardo Dos Santos: It could also have methane, nothing, nothing also produces hydrogen rich accessory as well, but it's probably not.

163

00:24:59.940 --> 00:25:15.030

Leonardo Dos Santos: As urgent hydrogen as if you were water. But anyway, I'm not the one that ran simulations for this but uh you if you found something like this around an exoplanet you can infer a little bit about composition, the lower atmosphere.

164

00:25:16.230 --> 00:25:18.570

Morgan Elowe MacLeod: I'd be, would you like to follow up on that. I don't

165

00:25:25.590 --> 00:25:27.240

loeb: You can just unmute yourself if you would

166

00:25:30.990 --> 00:25:35.340

loeb: The question is whether the there could be anything other than hydrogen detectable.

167

00:25:38.610 --> 00:25:41.010

Leonardo Dos Santos: In ultra violet can also look for oxygen.

168

00:25:42.180 --> 00:25:54.870

Leonardo Dos Santos: The problem with oxygen is that the signal will be even more attenuated the signal will be smaller, the Earth's atmosphere is also rich in an oxygen. And we see that when we take Hubble observations.

169

00:25:55.410 --> 00:26:03.780

Leonardo Dos Santos: Because for instance, would cause the what what I mentioned before, the Joker no admission. That's basically the Earth's exosphere shining on our instrument.

170

00:26:04.410 --> 00:26:13.980

Leonardo Dos Santos: There's also a lot of contamination from oxygen. So your sexual story is also reaching and oxygen. And there's a tiny little bit of nitrogen, but I think nitrogen would not be detectable for

171

00:26:15.270 --> 00:26:31.650

Leonardo Dos Santos: An exosphere earth like nitrogen would not be detected for an exoplanet but oxygen. It's possible. I think we would need a more transits to than 10 centimeters, but it also depends on the distance of the system. It depends on the

172

00:26:33.120 --> 00:26:38.250

Leonardo Dos Santos: There's actually a surprising dependence on the radio velocity of the style. The style is

173

00:26:39.690 --> 00:26:58.080

Leonardo Dos Santos: Has a high reading velocity. It's actually easier to detect these features, because you have the DSM absorption is going to happen away, far away from the on the seller emission lines. So it really depends on the on the whole snore.

174

00:26:59.100 --> 00:26:59.340

Morgan Elowe MacLeod: Say,

175

00:26:59.910 --> 00:27:00.360

Leonardo Dos Santos: As well.

176

00:27:01.530 --> 00:27:12.660

Leonardo Dos Santos: And by the way, we're not even talking about cell activity. These observations which would probably be present in there. So that's also something that we have to think about when planning. These observations.

177

00:27:14.340 --> 00:27:14.880

Interesting.

178

00:27:16.200 --> 00:27:25.200

Morgan Elowe MacLeod: Leonardo. Thank you so much, there are more questions on the slack than we have time to ask right now, but we're hoping you can chime in there as well. And we're

179

00:27:25.200 --> 00:27:29.280

Morgan Elowe MacLeod: really grateful for all your insights on this fascinating topic.

180

00:27:30.180 --> 00:27:31.020

Leonardo Dos Santos: Thank you very much.

181

00:27:32.430 --> 00:27:33.900

Ana Bonaca: Thanks. Thanks, Morgan.

182

00:27:35.010 --> 00:27:42.510

Ana Bonaca: Our next speaker today as he looked launch, who is a junior graduate student at technique in Israel.

183

00:27:43.920 --> 00:28:02.340

Ana Bonaca: And haleigh works on a topic that is near and dear to many of people in the IDC she's studying common antelope finer use and parcels are very exciting as in the context of gravitational wave detection, but also like she makes a connection to

184

00:28:03.930 --> 00:28:11.460

Ana Bonaca: A very important face of stellar evolution, like the like the ATV stars that there are really important as

185

00:28:12.780 --> 00:28:25.890

Ana Bonaca: Luminous starts to dominate extra galactic sources as well. So it's really important to understand these phases of stellar evolution in more detail. And so today we're fortunate to hear from this

186

00:28:27.060 --> 00:28:29.850

Ana Bonaca: Area in new work from hello

187

00:28:30.930 --> 00:28:38.310

Ana Bonaca: Hello, I think you can share the screen and take it away.  
Yeah, thank you for the introduction.

188

00:28:39.540 --> 00:28:42.240

Hila Glanz: Can you see my screen and the mouse. Yes.

189

00:28:44.040 --> 00:28:48.870

Hila Glanz: So hi, everyone, and thank you so much for inviting me to  
share my work with you.

190

00:28:49.200 --> 00:28:54.810

Hila Glanz: So I'm like Lance a PhD student at the Technion in Israel  
currently on my first year.

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00:28:55.380 --> 00:29:06.030

Hila Glanz: And today, I'll talk about a new perspective on the common  
envelope of evolution, and in particular focus on our research about the  
rejection of the common envelope by Ross Rubin wins.

192

00:29:06.750 --> 00:29:14.910

Hila Glanz: All of this was done together with my Masters and PhD advisor  
guides, which I think is also here and he is also from the Technion

193

00:29:17.370 --> 00:29:17.580

Okay.

194

00:29:18.720 --> 00:29:35.370

Hila Glanz: So before we go directly to the problem of the common  
envelope. Let's look at the evolution of a single star which is much  
better understood. So if we take, for instance, a sunlike star after  
finishing this hydrogen. Hydrogen burning at its core, the core shrinks  
and envelope expands.

195

00:29:36.630 --> 00:29:50.940

Hila Glanz: And cool down so it moves to the a re that region branch then  
have after the chorus dance and warm and after united helium burning it  
moves to the horizontal branch. And then after some some time it starts  
to

196

00:29:52.020 --> 00:29:56.790

Hila Glanz: Burn helium at its outer shells and move to the asymptotic  
giant branch or AGB

197

00:29:57.540 --> 00:30:12.960

Hila Glanz: Their experiences thermal pulsation that caused the loss of most of its envelope by slow solar winds, until finally its outer envelope is rejected and becomes the Crab nebula, then its remnant core becomes the white dwarf.

198

00:30:14.550 --> 00:30:31.620

Hila Glanz: So now we know that if the star is the closest companion its evolution probably will be different because if the two objects are close enough, they transform us from one to the other by mass overflow and if the response is not stable than a shared envelope is formed. And this is a combination

199

00:30:32.700 --> 00:30:40.740

Hila Glanz: So we believe the combination of phases has an important role in evolution of many binaries and multiple systems and this includes

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00:30:41.430 --> 00:30:46.620

Hila Glanz: For indicators of explosive events such as Type I supernovae.

201

00:30:47.610 --> 00:30:55.260

Hila Glanz: gamma ray bursts x-ray binaries double pulsars neutral stars that can produce gravitational waves and many more.

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00:30:55.740 --> 00:31:05.760

Hila Glanz: And the reason that we think that those systems have experienced the common envelope phase is that if we follow that single stellar evolution theory which I just briefly presented

203

00:31:06.270 --> 00:31:22.200

Hila Glanz: At least one of the components should have wanted to be in much larger than their current orbital separation. So, this implies that there should have been some migration process and the planets look at their envelopes somehow we evaporated.

204

00:31:23.880 --> 00:31:34.680

Hila Glanz: So let's go briefly through the main stages of common envelope which will also be indicated here as well. So first of all its formation, then the fast inward spiral motion of the

205

00:31:35.430 --> 00:31:43.290

Hila Glanz: Two components inside the envelope and then a final and longer state which might happen in which to share envelope is eventually ejected

206

00:31:43.950 --> 00:31:54.690

Hila Glanz: So the first one. Information is most likely derived by the evolutionary growth of one of the components. So the star which is also called a call the creamery Don or

207

00:31:55.140 --> 00:32:01.740

Hila Glanz: A star grows to register which is large enough to fill its roof slope and then France for master its companion.

208

00:32:02.670 --> 00:32:21.360

Hila Glanz: And then if this process is not stable so that a Masters for is too high or the orbital angular momentum is to our system is unable to synchronize the motion of the envelope and the two cores and this leaders for it to the next stage, which is the fast spiral and

209

00:32:22.530 --> 00:32:39.870

Hila Glanz: It's also happening at an article timescale. And what happens is the companion spiral deeper and deeper inside the envelope and in order to conserve the angular momentum. The envelope expense and at the end of the stage, the envelope might be rejected away and the to

210

00:32:40.980 --> 00:32:45.300

Hila Glanz: Maybe remnants a marriage or remaining a short sale or

211

00:32:46.620 --> 00:32:56.790

Hila Glanz: Afterwards, if the envelope is not yet been educated or and bonded there will maybe and other longer face which we call the self regulating phase.

212

00:32:57.300 --> 00:33:09.180

Hila Glanz: And in which you do dissipation and dynamic of friction, the spiral emotion may slow down enough to synchronize then after a few dynamical stay is timescales.

213

00:33:09.720 --> 00:33:19.770

Hila Glanz: The common over process may happen all over again, or there will be some other important processes. During this stage that can derive the envelope outwards.

214

00:33:20.220 --> 00:33:37.650

Hila Glanz: And then finally do envelope is being ejected from the system. And the reason that we believe that the envelope must be rejected at the end is that its remaining recalls that would cause the mutual measure of any post communist or binary, but we do have the observed such survivors.

215

00:33:39.450 --> 00:33:51.870

Hila Glanz: And so, Eddie. And we will be left with a binary system consisted of the remnant core and the companion, probably in a short period or with or with one star which is

216

00:33:52.650 --> 00:34:04.020

Hila Glanz: Which has been formed from the measure of the donors core and the companion and they rejected gas will be as a type of a plan to enable or somewhere around the system.

217

00:34:05.580 --> 00:34:14.220

Hila Glanz: And after we went through all the stages. Let's see an example. So here is one of the hydro dynamic simulation which which is actually a part of our

218

00:34:15.000 --> 00:34:21.330

Hila Glanz: Recent work about three, four common envelope. And what we see here is the common envelope evolution of a

219

00:34:21.960 --> 00:34:30.000

Hila Glanz: solar masses. Red Giant we Jerusalem as companion at a distance which is why society of the giants radius.

220

00:34:30.660 --> 00:34:37.710

Hila Glanz: So we can see the formation of the common envelope and they're very rapid spiral in of the companion, and then the expansion.

221

00:34:38.310 --> 00:34:51.870

Hila Glanz: Of the envelope. As a consequence, I hope there is solution is good enough via zoom. So you can see that now the companion moves more rapidly and deeper in the envelope until, in this case they finally merge.

222

00:34:54.990 --> 00:35:01.020

Hila Glanz: So we can divide remain open questions or goals of the common envelope evolution into two groups.

223

00:35:01.350 --> 00:35:08.760

Hila Glanz: The first one is about the migration process and, in particular, what are the connections between the initial condition of interacting system.

224

00:35:09.180 --> 00:35:21.420

Hila Glanz: And the final outcomes. The final observation observable system day over top parameters stereotypes and what happened if the system is more Cocos as it should be for triple system.

225

00:35:22.200 --> 00:35:31.890

Hila Glanz: And the second question is about the rejection of the envelope. What causes complete and binding and how much time that it takes does happen during this a spiral in

226

00:35:32.340 --> 00:35:41.760

Hila Glanz: Or in a longer time scale, like in the self regulating face. So today I'll start by presenting the scenario that can help us solve the question of the envelope rejection

227

00:35:42.390 --> 00:36:00.810

Hila Glanz: And if we'll have time will maybe talk shortly about some other works. We can't be working on that relate to the first question, and are indicated here on purpose. And in any case, they will be very happy to discuss them later on. Later on here via slack or wherever you want.

228

00:36:02.370 --> 00:36:08.130

Hila Glanz: So the problem is that even though this process was simulated many times, also by us.

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00:36:08.640 --> 00:36:17.670

Hila Glanz: No one could actually reject the entire envelope, but only a few percent and it's mostly been the rain bounded at the end. So, which means that there should be

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00:36:18.150 --> 00:36:22.710

Hila Glanz: Probably another physical process involved, which was not considered previously.

231

00:36:23.520 --> 00:36:32.400

Hila Glanz: So now, if you remember the first slide, you probably understand why we talked about evolution of a single star and, in particular, we mentioned the rejection of the envelope.

232

00:36:32.730 --> 00:36:43.440

Hila Glanz: At the end of it's a GB face which we mostly know how to explain. So let's see if it's possible to use the same mechanism, also for a giant that goes through a common and will face.

233

00:36:44.310 --> 00:36:50.430

Hila Glanz: And this is exactly what we investigate and in this research about efficient common and will ejection for data driven

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00:36:51.570 --> 00:36:56.310

Hila Glanz: So first let's understand better the rejection of the single ADB star.

235

00:36:57.270 --> 00:37:12.540

Hila Glanz: So the ADB star experienced thermo pulsation that push material from the inner layer outwards to a distance or the temperature is low enough to allow that formation. So some different the material is condensed to dust and some collide with you.

236

00:37:13.980 --> 00:37:23.820

Hila Glanz: Know the dust is higher positive in its surrounding so it's being pushed away but irradiation for a pressure from the seller of core and by collision uncoupling with the guests.

237

00:37:24.510 --> 00:37:39.390

Hila Glanz: It accelerates gas away from the star. So, without did us the gas, which is pushed away. We'll just go down and lose all the Skinner, he has a kinetic energy and then fall back to the star. But now, as the dust gains momentum from

238

00:37:40.440 --> 00:37:53.550

Hila Glanz: Absorbing scattering is a fortune from the star and is pushed outward, it will produce drug force on the colliding gas molecule. And now the gas can pass his escape velocity and rejected.

239

00:37:55.080 --> 00:38:02.880

Hila Glanz: So the first condition to allow desert when, when is that the luminosity of the star can overcome is gravitational forces.

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00:38:03.210 --> 00:38:12.810

Hila Glanz: So we can define this gamma to be the ratio between relative acceleration to gravity and it will take volume weighted in Unity were wins can accrue

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00:38:13.560 --> 00:38:24.990

Hila Glanz: And we can see that this ratio is larger for larger luminosity is and larger capacities and it's actually that determines whether the motion is dominated by radiation pressure or by gravity.

242

00:38:26.700 --> 00:38:38.850

Hila Glanz: And the condensation temperature depends on the type of brains, which is affected by the chemical composition of the star and the ratio between carbon and oxygen. But it's mostly around 1500 Kelvin.

243

00:38:39.660 --> 00:38:55.650

Hila Glanz: And in order to have an efficient process, there should be a region where there will be enough material that can condense into dust. The temperatures will be low enough so this does one sublimate and the dust should be in relative equilibrium in order to form and grow.

244

00:38:57.420 --> 00:39:09.660

Hila Glanz: And we can find this minimal condensation radius of the star A from its relative equilibrium between the heating from the stellar light and thermal cooling of the spring.

245

00:39:10.380 --> 00:39:23.310

Hila Glanz: The heating mostly depends on the optical depth of this region which is mostly in had a optically thankful for LGBT star because it's much above it surface.

246

00:39:24.030 --> 00:39:33.810

Hila Glanz: And then we can make some approximation we take up to be the power dependence of the paucity on the wavelength to be one, which is

247

00:39:34.290 --> 00:39:43.860

Hila Glanz: The average for type of brands, which are most likely to form inside like evolve, sir. And then we construct this relation between the minimal condensation radius and the

248

00:39:44.430 --> 00:39:59.610

Hila Glanz: Parameters of our evolve, sir. And if we substitute vital for any balsamic style, we get that eat somewhere around 700 solar ready I much above the red use of the star which is around 200

249

00:40:02.340 --> 00:40:11.520

Hila Glanz: So overall what happened in this process is this material from the star should reach a region where it is cool enough to allow does condensation

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00:40:11.940 --> 00:40:18.210

Hila Glanz: Then the radiation pressure on the disk should be high enough so the gas can overtake his escape velocity

251

00:40:18.750 --> 00:40:33.600

Hila Glanz: And that should be enough material that can interact with this stuff and be rejected. As a consequence, so now let's show that this condition also hold for both common envelope giants. So for a TV star. It's quite reasonable. But what about red giants.

252

00:40:34.860 --> 00:40:44.190

Hila Glanz: So during the common envelope phase, the envelope expense extensively even beyond the region where the temperature is low enough to allow does formation.

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00:40:44.820 --> 00:40:57.690

Hila Glanz: Then it is reduced density is of the same order of magnitude as the density of the pulsating guys have a single ATP star and the red Genco also radiates on this does with a comparable luminosity.

254

00:40:59.160 --> 00:41:06.150

Hila Glanz: So now the different is that this region is inside so envelope and not outside as it in a single ADB

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00:41:06.720 --> 00:41:16.350

Hila Glanz: So we don't need those pulsation to bring their material to condense it to docs and to interact with with this, but on the other end, we should take into account that it's now located inside and

256

00:41:16.800 --> 00:41:28.620

Hila Glanz: Optically fictional and nothing as it was in the outer region. So we can let us know neglect luminosity of the companion and seems the common envelope happens in a dynamical time skill.

257

00:41:29.490 --> 00:41:46.950

Hila Glanz: The total luminosity which originates in their nuclear reactions in the core do not change. So we can construct this relation between the effective temperature it is a radius after the common envelope and their initial parameters of the star prior to the combination will face.

258

00:41:48.540 --> 00:42:00.630

Hila Glanz: And also wanted drove a new condition of the star. So we have the stellar core which radiates on the outer shells, then at some point the effective temperature becomes the condensation temperature so desk and form.

259

00:42:01.200 --> 00:42:11.850

Hila Glanz: And gamma, which is the ratio between the ready it radiation acceleration to gravity. It goes very fast and becomes rated in unity, which applies that

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00:42:12.690 --> 00:42:33.480

Hila Glanz: Wins can occur. And this does a driven region continues until gamma drops to unity back and the winds can load or no longer possible but we expect that the region above if exist will also be pushed away by collision with the material that is removed from the dust driven wins.

261

00:42:35.520 --> 00:42:46.440

Hila Glanz: And we can follow the same calculation to find the conversation register, but inside an optical fictional and would you think that temperature violation that we just arrived and

262

00:42:48.030 --> 00:42:58.920

Hila Glanz: We get this dependence between the current the minimal conversation reduce and the initial parameters have to start before the Communists look again. And if we plug in the

263

00:42:59.940 --> 00:43:02.550

Hila Glanz: Default for an evolved sunlight into red giant

264

00:43:02.700 --> 00:43:04.890

Hila Glanz: After a combination of forget about

265

00:43:05.310 --> 00:43:13.170

Hila Glanz: 350 solar radiation. So it's really deeply inside extended envelope so there isn't it.

266

00:43:13.350 --> 00:43:18.300

Hila Glanz: does indeed no need for at the pulsation, because the material is already there.

267

00:43:20.100 --> 00:43:33.930

Hila Glanz: And if we want to talk about the time of her evaporation. So it's mainly derived from the amount of material which can condense it us the amount of energy that Fridays on the dust and the amount of material that the dust can push up

268

00:43:35.130 --> 00:43:44.040

Hila Glanz: And we can make some order of magnitude calculation to find this ejecting time and if we want to do a simple momentum consideration.

269

00:43:44.850 --> 00:43:55.560

Hila Glanz: Of the envelope above this conversation, reduce and the energy from the accelerated. That's a then we get to the site timescale daily operation should be quite similar.

270

00:43:56.430 --> 00:44:09.780

Hila Glanz: To the one of a single ADB star which is in a good correlation with work done by McKellen parents and you go shuttle is also suggested long time scale for the common envelope rejection

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00:44:11.820 --> 00:44:25.800

Hila Glanz: And now let me show you an example we did to examine them and demonstrate our calculation. So we simulated sunlight star, which was evolving to a giant with 83 solar radiation and luminosity have about 1000 solo luminosity is

272

00:44:27.090 --> 00:44:36.660

Hila Glanz: We took main sequence companion with almost identical mass and put it just on the age of the envelope so we forced the common envelope process to begin

273

00:44:38.430 --> 00:44:54.240

Hila Glanz: We ran everything via the muse framework, we created our red giant model using Meza and then we met this model to 3D SP age model with the core and compare companion as point masters.

274

00:44:54.780 --> 00:45:07.500

Hila Glanz: And we use gadget to to simulate the common envelope evolution. We first ran some relaxation stage to avoid sudden it to avoid them potential for says that

275

00:45:08.250 --> 00:45:18.870

Hila Glanz: Was co workers by the sudden change in resolution and in the equation of state within the different codes and then we ran the common and rope evolution itself for 1400 days.

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00:45:20.100 --> 00:45:28.050

Hila Glanz: Until at the end, the system has been satellite in a short period over it with the steel bondage began to envelope around it.

277

00:45:28.680 --> 00:45:39.510

Hila Glanz: Then we calculated ready condensation reduce should be and check the other condition. So we've not, it actually simulated the dust, but only calculated is approximate affection.

278

00:45:41.130 --> 00:45:54.990

Hila Glanz: And this is a cumulative a mass distribution. After the combination of brushes and it shows here the conversation rages in a dashed line and we see that, indeed, most of the steel bonded envelope is above this

279

00:45:56.220 --> 00:46:05.580

Hila Glanz: Radius, which means that if this process can successfully reject all the material above this does formation region, it should be very efficient.

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00:46:07.020 --> 00:46:12.900

Hila Glanz: And here is another comparison between a sonic style which was evolving to an add

281

00:46:13.830 --> 00:46:23.280

Hila Glanz: On the left, and our post common and go project on the right that dashed line is the is where the industry form and here on the left, we see that

282

00:46:24.000 --> 00:46:30.150

Hila Glanz: The HTTP server must have the pulsation to bring the material to this does formation, a reduced

283

00:46:30.990 --> 00:46:50.130

Hila Glanz: To form it and to interact with it. And on the right, in our POS Commonwealth project it's deeper and deeper inside the external envelope so there is no need for rose position because the materials already there, although those might happen, and even make this process even more efficient.

284

00:46:51.450 --> 00:47:10.620

Hila Glanz: This another comparison between the average ATP star and our post common and vote for a giant and we see that its density profile continuum, way beyond the size of the singularity be star and its density around the dust formation region are indeed comparable.

285

00:47:12.240 --> 00:47:24.150

Hila Glanz: And if we want to summarize this process. So we found a potential new efficient channel to reject the common envelope by the same model that was suggested for rejection of the ATP still envelope and

286

00:47:24.750 --> 00:47:39.990

Hila Glanz: Since most of the common law books and the young adult formation reduce the muscle through desperate when when should be very effective and in principle the common envelope can look very similar to the ADB stage and rejection time will be also be comparable.

287

00:47:41.400 --> 00:47:52.740

Hila Glanz: And in order to improve our walk, we still need to count for the different type of brains. They can differ in their conversation temperature the absorption efficiencies and sizes.

288

00:47:53.460 --> 00:48:06.330

Hila Glanz: And the disk and also form in a spiral phase. So, we should take this into account also in the calculation of the ejection time and also in the affection of the combo envelope evolution itself.

289

00:48:06.990 --> 00:48:21.720

Hila Glanz: And we still need to make a complete simulation, which includes the covenant vote evolution, together with does formation radiation pressure and some other important processes like heating and cooling via convection erosion and many more.

290

00:48:22.860 --> 00:48:33.090

Hila Glanz: And so I think that's now my time as and as everyone. So thank you very much for listening and feel free to ask me any question.

291

00:48:38.730 --> 00:48:39.390

Thank you.

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00:48:41.400 --> 00:48:41.820

Morgan Elowe MacLeod: So,

293

00:48:43.470 --> 00:48:47.070

Morgan Elowe MacLeod: I, I have a question. And I think it relates really

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00:48:48.300 --> 00:48:49.890

Morgan Elowe MacLeod: Closely to

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00:48:51.000 --> 00:49:02.160

Morgan Elowe MacLeod: One that Yvette cinders is up asking, and that has to do with the observational appearance of these sources during the

296

00:49:02.670 --> 00:49:22.290

Morgan Elowe MacLeod: 10s of thousands potentially of years that it takes for this envelope to eventually be evaporated. And so first of all our

are we correct in understanding that the current thinking is that the power of the star takes takes 10 to the 410 to the five years to drive off the envelope.

297

00:49:23.340 --> 00:49:31.740

Hila Glanz: So if there's no more help, like from other processes. Yes, all only by data driven when probably yes.

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00:49:31.920 --> 00:49:32.250

Morgan Elowe MacLeod: Yeah.

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00:49:32.340 --> 00:49:38.610

Hila Glanz: I mean, we didn't do that, the more accurate calculation by including all of the

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00:49:39.630 --> 00:49:42.420

Hila Glanz: The other processes and heating and cooling but

301

00:49:42.900 --> 00:49:52.560

Morgan Elowe MacLeod: Yes. Right, right. So, potentially, they could play off each other in sort of an interesting nonlinear way yes would change the answer. Yep. Yep.

302

00:49:52.680 --> 00:49:53.580

Morgan Elowe MacLeod: That's a really good point.

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00:49:54.720 --> 00:50:05.430

Morgan Elowe MacLeod: And. Okay. So then the question. I think that I've wondered, for a long time and and we're also hearing from the audiences. We have really beautiful evidence for

304

00:50:06.600 --> 00:50:11.730

Morgan Elowe MacLeod: Objects that we think are either mergers are coming on below transients

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00:50:12.930 --> 00:50:26.160

Morgan Elowe MacLeod: First should exhibiting sort of optical transients like signatures. So I'm thinking about an object like the 38 Mon that you had the beautiful light echo from

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00:50:27.330 --> 00:50:27.810

Morgan Elowe MacLeod: And

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00:50:29.580 --> 00:50:43.440

Morgan Elowe MacLeod: Then for having these really incredibly sort of dust rich remnants. And so I think that's clear evidence that the sorts of processes that you're alluding to are happening.

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00:50:44.790 --> 00:50:47.250

Morgan Elowe MacLeod: But then the question is,

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00:50:49.740 --> 00:51:09.450

Morgan Elowe MacLeod: How I i guess i i want to break it up into two parts. So how do we observe this in action. And if we see, you know, a desperate source, what can we do to identify with this process as opposed to, say, a single star ADP objection.

310

00:51:11.010 --> 00:51:16.470

Hila Glanz: Yeah. Um, so I'm not sure I can complete see answer this, but

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00:51:16.770 --> 00:51:17.640

Morgan Elowe MacLeod: Totally fair

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00:51:17.760 --> 00:51:27.540

Hila Glanz: Yeah, but unfortunately I think them seems the companion is probably less evolved and probably it's luminosity will be

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00:51:29.070 --> 00:51:34.860

Hila Glanz: A ignorable so I'm not sure it's really easy to to

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00:51:36.120 --> 00:51:39.660

Hila Glanz: Yeah, to make this separation between

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00:51:41.130 --> 00:51:44.070

Hila Glanz: Single agent bestar and and the common envelope. Yeah.

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00:51:44.460 --> 00:51:45.570

Morgan Elowe MacLeod: Yeah, it's a really

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00:51:46.350 --> 00:51:48.210

Hila Glanz: Blocks all of the city and

318

00:51:49.110 --> 00:51:49.470

Hila Glanz: Yeah.

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00:51:49.800 --> 00:51:58.440

Morgan Elowe MacLeod: So you see some Dustin treaded luminous source. And then my other question is, I think it would be absolutely amazing. If we could

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00:51:59.760 --> 00:52:17.730

Morgan Elowe MacLeod: See some post interaction remnant like this. Some duster trim and ask whether there was a emerged binary at the core, or a sort of surviving separated binary at the core. So you're talking about two scenarios where

321

00:52:18.780 --> 00:52:36.600

Morgan Elowe MacLeod: Essentially the same process happens up until there's one outcome or another. And I was curious whether you had any insight from your work on whether on ways we might distinguish the outcome when we're when we're sort of observational II looking at these sources so

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00:52:36.630 --> 00:52:43.350

Hila Glanz: I'm not sure the dust has any connection with it, but understanding better common envelope evolution itself.

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00:52:43.950 --> 00:53:03.480

Hila Glanz: So how much does the envelope expands in a, in a case that they finally marriage I in comparison to where you have a short period or between the end interest and maybe the shape of this planetary nebulae. Mm hmm. So I yeah

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00:53:03.960 --> 00:53:07.560

Morgan Elowe MacLeod: Yeah, so maybe they've been like sort of secondary features like that.

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00:53:07.950 --> 00:53:11.280

Morgan Elowe MacLeod: That's really interesting. And then another nonsense asking

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00:53:13.320 --> 00:53:32.910

Morgan Elowe MacLeod: If sort of following up on on the appearance of these envelopes over time would something like kinematic data from Gaia help in identifying those sorts of sources from sort of in a separate population of KGB stars are posted up

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00:53:32.970 --> 00:53:40.650

Hila Glanz: I'm not sure the guys here, but they have a paper that they use. If you go chef at all. And the user guide to

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00:53:41.850 --> 00:53:43.500

Hila Glanz: To say some some

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00:53:44.940 --> 00:53:54.660

Hila Glanz: Predictions about the timescales of the common envelope. And so perhaps you can say some more about this. I'm not sure that it depends.

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00:53:55.710 --> 00:53:57.300

Hila Glanz: On just formation, but

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00:53:58.170 --> 00:54:03.390

Hila Glanz: I'm sure you use Gaya to to enrich this discussion. Yeah.

332

00:54:04.290 --> 00:54:23.280

Morgan Elowe MacLeod: And then I think we have time for about one last question. And that's from Paul green and who's asking do we know how much mass, the main sequence companion might accrete in that process. And is that tracked in your simulations.

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00:54:25.020 --> 00:54:34.260

Hila Glanz: Will know in this simulation, we didn't account. The equation because we tried this and it was very low.

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00:54:35.340 --> 00:54:41.730

Hila Glanz: Ratio and compared to its mass, so we can sell it to to have a better resolution.

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00:54:44.400 --> 00:54:54.450

Hila Glanz: So I'm not sure I can answer you this now, but I do have like test results. So I can maybe I can maybe find them for you if you want. And we can discuss this later on.

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00:54:54.750 --> 00:55:00.270

Morgan Elowe MacLeod: Nice. Well, that might be a nice avenue for further discussion on the slack and also the Link You're mentioning

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00:55:01.470 --> 00:55:11.910

Morgan Elowe MacLeod: Well, thank you. I, I, I'm really just sort of personally optimistic that that this sort of insight that you're bringing to this problem. I think will be really fruitful and

338

00:55:12.240 --> 00:55:21.120

Morgan Elowe MacLeod: And understanding and and also in combination with with all of the different data sources that you've been mentioning we pull all that information together with the sort of modeling, you're doing

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00:55:21.750 --> 00:55:28.770

Morgan Elowe MacLeod: I'M HOPEFUL WE CAN MAKE we can make progress. So I was really delighted to hear your ideas. Thank you.

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00:55:31.440 --> 00:55:42.780

Ana Bonaca: And with that, we bring this week scientifically coming to a close. Thank you for coming. Thanks, and they're doing a lot for wonderful box, please stick around on Slack.

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00:55:44.580 --> 00:55:47.130

Ana Bonaca: Yeah, there have been some more questions.

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00:55:48.330 --> 00:56:05.400

Ana Bonaca: And yeah, keep in mind for like we are meeting again next week. So there is a local people in the audience, we have something called to tell us about and in five minutes or less please sign up for our CFO bite and you'll see you next week.

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00:56:07.050 --> 00:56:07.770

Morgan Elowe MacLeod: Thank you.

344

00:56:08.640 --> 00:56:10.680

Morgan Elowe MacLeod: Bye Bye bye.